EDUCATIONAL INTERVENTION FOR GASTRIC ULTRASONOGRAPHY COMPETENCY AMONG ANESTHESIA PROVIDERS

by

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A DNP Project Submitted to the Faculty of the

COLLEGE OF NURSING

In Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF NURSING PRACTICE

In the Graduate College

THE UNIVERSITY OF ARIZONA

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THE UNIVERSITY OF ARIZONA
GRADUATE COLLEGE

As members of the DNP Project Committee, we certify that we have read the DNP project prepared by *Tricia M. Hoffner*, titled *Educational Intervention for Gastric Ultrasonography Competency Among Anesthesia Providers* and recommend that it be accepted as fulfilling the DNP project requirement for the Degree of Doctor of Nursing Practice.

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Final approval and acceptance of this DNP project is contingent upon the candidate's submission of the final copies of the DNP project to the Graduate College.

I hereby certify that I have read this DNP project prepared under my direction and recommend that it be accepted as fulfilling the DNP project requirement.

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ACKNOWLEDGMENTS

I would like to express my special thanks and gratitude to my committee chair Dr. Sarah Torabi and committee members Dr. Kathleen Piotrowski and Dr. Kristie Hoch. I am thankful for their generous time, constant encouragement, support, and guidance that helped bring this project to fruition. I am privileged to have such an inspiring team of leaders' aide me in the completion of this project. I would also like to extend a special thanks to the team of exceptional providers at Twin Oaks Anesthesia, specifically Brian Selai, MSN, CRNA, and Jonathan Kline, MSNA, CRNA, for providing the inspiration of gastric ultrasonography for my project.

DEDICATION

I would like to dedicate this DNP project to my loving parents, Grant and Julie Hoffner. You have always been my biggest support system and cheerleaders.

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ABSTRACT

The purpose of this Doctor of Nursing Practice (DNP) project was to assess knowledge in gastric image recognition after an educational presentation. Pulmonary aspiration of gastric contents is a feared anesthetic complication among Certified Registered Nurse Anesthetists (CRNAs) and Anesthesiologists as it is associated with increased patient morbidity, mortality, and healthcare costs, occurring as often as 1 in every 2-3,000 cases (Nason, 2015). Current aspiration risk stratification often solely relies on the American Society of Anesthesiologists (ASA) guidelines or a patient's "nothing by mouth" (NPO) status. However, these guidelines fail to inform providers about the quality and nature of a patient's gastric content, which are directly associated with the potential severity of aspiration (Putte & Perlas, 2014). Gastric ultrasonography offers an alternative, valid and reliable assessment of gastric contents and volume allowing anesthesia providers to better predict a patient's risk of aspiration (Bisinotto et al., 2017). To assess knowledge of gastric image recognition, a pretest of gastric images was administered before an educational presentation with a posttest administered immediately afterward for participants at a hospital in Phoenix. Data analysis resulted in a mean pre-test score of 4.76/8 or 59.6% (SD = 19.4%) and a mean post-test score of 7.06/8 or 88.2% (SD = 10.9%), indicating increased provider accuracy in identifying different types and volumes of gastric contents. In conclusion, anesthesia providers may continue to develop their gastric ultrasonography interpretation skills with hopes of adopting this noninvasive tool into their anesthetic plan of care, ultimately decreasing perioperative aspiration risk thereby potentially improving patient, provider, and healthcare facility outcomes.

INTRODUCTION

A feared complication of anesthesia for surgery is pulmonary aspiration of gastric contents, which is the entry of liquid or solid material into the lungs and occurs as often as 1 in every 2-3,000 cases (Nason, 2015). This fear is especially prevalent for Certified Registered Nurse Anesthetists (CRNAs) and Anesthesiologists performing the anesthesia as they know the risks. Aspiration accounts for as high as 19% morbidity and 9% of anesthesia-related mortalities throughout the perioperative period and correlates with provider liability and litigation (Putte & Perlas, 2014). Perioperative aspiration of gastric contents can lead to the development of pneumonia or pneumonitis, leading to poor patient, provider, and healthcare facility outcomes (Nason, 2015).

Background Knowledge

Aspiration pneumonitis, initially described by Mendelson in 1946, is damage to the lung parenchyma resulting from inhalation of acidic gastric contents. The severity of the injury is dependent on acidity and volume of gastric contents and the presence or absence of particulate matter. Injuries with low pH, high volume, and particulate present place the patient at the highest risk for aspiration (Nason, 2015). Furthermore, one study by Wu and colleagues (2017) estimated the average cost of a single case of a complication from aspiration, such as pneumonia, to be $16,173-$30,526, an overwhelming amount burdening both patients and healthcare facilities.

Current practice guidelines regarding the amount of gastric content often exclusively rely on fasting guidelines and a patient's "nothing by mouth" (NPO) status. The American Society of Anesthesiologists (ASA) recommends restricting ingestion of solid foods six hours before

surgery and clear liquids two hours before surgery (ASA Task Force, 2017). These guidelines, however, tell anesthesia providers nothing about the quality and nature of a patient's gastric content, which are directly associated with the potential severity of aspiration (Putte & Perlas, 2014). Fasting guidelines also prove meaningless in patients who have not abided by them either to lack of understanding, neglect, or need for emergency surgery. Moreover, these guidelines are insufficient for patients with co-morbidities that delay gastric emptying such as advanced renal or liver failure, neuromuscular disorders, and gastroparesis secondary to diabetes, pain, opioid consumption, or bowel obstruction (Kline, Selai, Ardigo, & Pugh, 2017). Ultimately, these vulnerable patient populations, considered to have a "full stomach," can have surgery canceled, or entails a rapid sequence induction and intubation without proper gastric emptying and premedication to prevent aspiration of gastric contents (Putte & Perlas, 2014). In conclusion, patient risk factors regarding aspiration risk directly influence anesthesia provider's perioperative plan of care.

A literature review was conducted which shows overwhelming evidence for the effectiveness of utilizing ultrasonography to asses a patient's gastric contents and volume, therefore providing valid and reliable evidence pertaining to a patient's risk of aspiration (Bisinotto et al., 2017). This noninvasive tool, gastric ultrasonography, produces images of a patient's gastric antrum and measures the cross-sectional area of gastric contents. This measurement, along with the application of a mathematical model, reliably estimates gastric volume and therefore informs anesthesia providers of a patient's aspiration risk. The use of gastric ultrasonography can prevent aspiration in preoperative patients, and thus further improve patient outcomes (Bouvet et al., 2011). Educating and engaging key stakeholders, such as

anesthesiologists, CRNAs, surgeons, and perioperative staff will incorporate this literature and evidence-based outcomes.

Local Problem

An informal needs assessment survey of anesthesia providers on their preoperative assessment indicated there is an imperative need for an additional assessment tool to stratify aspiration risk in preoperative patients. This Level 1 trauma center where the needs assessment was conducted, located in Phoenix, AZ, encompasses vulnerable populations such as burn, trauma, and patients with multiple co-morbidities, such as the ones previously discussed. As a Level 1 center, they receive 71,780 emergency visits, and 1,935 trauma visits annually (Maricopa Integrated Health Systems, 2016). Their patient population also consists of a majority of ASA III status patients, which are patients with severe systemic disease such as poorly controlled diabetes, morbid obesity, active hepatitis, and alcohol abuse, all of which are at increased risk of aspiration (ASA, 2014). Other than traditional ASA fasting guidelines, the Level 1 trauma center lacks a useful tool to further assess these patient's aspiration risk. After consulting with the Chief of the Anesthesia Department, the need for an educational presentation regarding a revised aspiration risk assessment came to fruition.

Purpose

The purpose of this Doctor of Nursing Practice (DNP) project was to assess knowledge in gastric image recognition after an educational presentation. The educational presentation included efficacy and usefulness of gastric ultrasonography, how ultrasound can be used to assess for gastric contents, and how to interpret the ultrasound images. Specific knowledge included increased accuracy in identifying different types of gastric content (solid vs. liquid) and

increased accuracy in identifying different volumes of gastric content (empty antrum vs. full antrum). The measurement used to assess this was a questionnaire which included gastric content classification images consisting of empty, empty antrum, liquid, or solid, full antrum. Theoretically, increased confidence and accuracy with gastric ultrasound utilization will prompt anesthesia providers to adopt the noninvasive tool as part of their aspiration risk assessment (Putte & Perlas, 2014). This will ultimately lead to better prediction of aspiration risk, implementation of interventions to prevent aspiration in the preoperative period, and moreover, decreased aspiration among patients during the perioperative period. Decreased incidence of aspiration will ultimately lead to improved patient, provider, and healthcare facility outcomes, as well as significant cost savings.

Project Question

The question pertaining to this DNP project is as follows, "In anesthesia providers, does instructional activity with ultrasonography increase provider accuracy in identifying different types and volumes of gastric contents?"

THEORETICAL FRAMEWORK AND SYNTHESIS OF EVIDENCE

Gagné's Nine Events of Instruction

An instructional design model is an invaluable tool to facilitate a curriculum outline. It enables educators to structure their teaching methods to assure a comparable learning experience among learners. A design model also helps identify an educational program's strengths and weaknesses, and where improvements can be made (Cheung, 2016). For this DNP project, Gagné's nine events of instruction (Figure 1) are the blueprint to formulate a teaching plan for educating anesthesia providers.

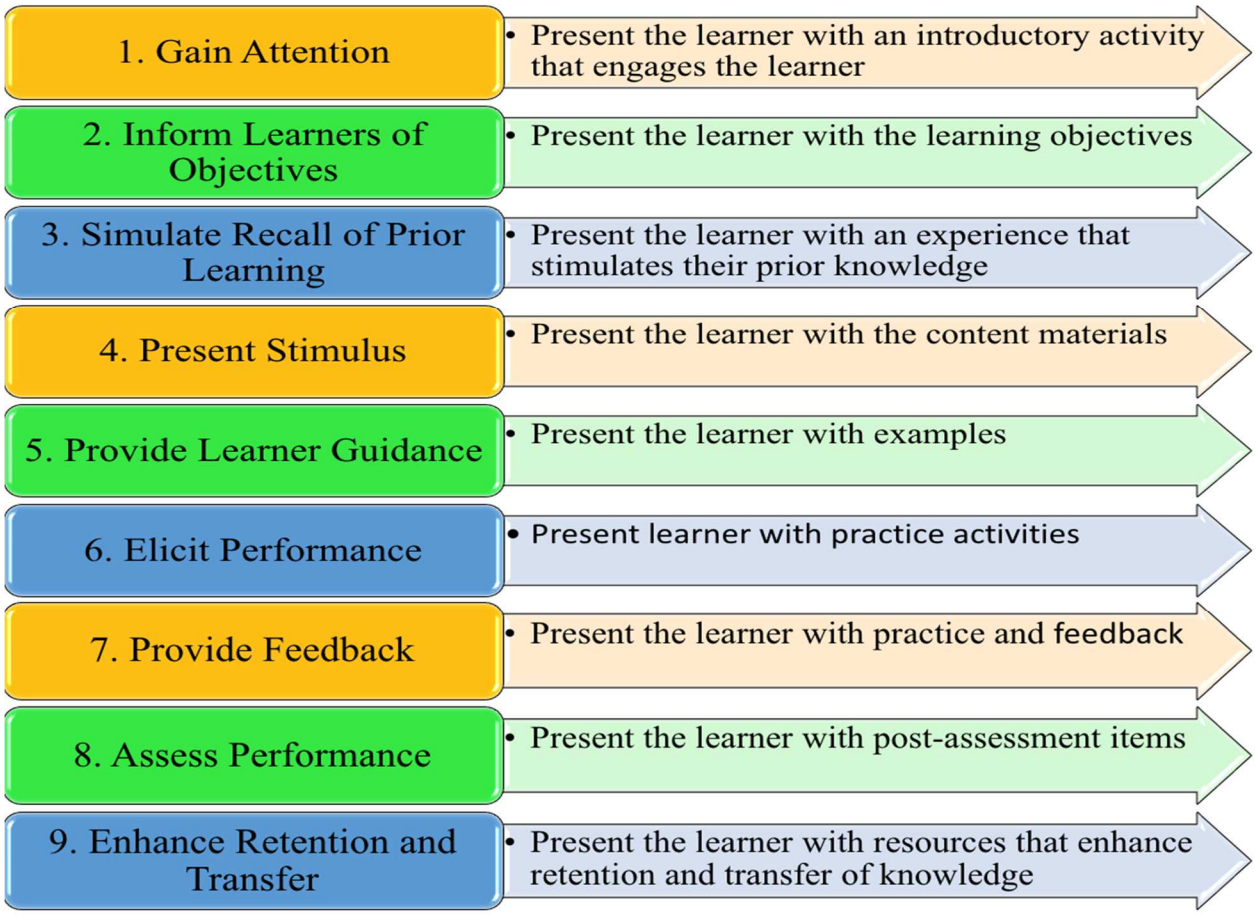


FIGURE 1. Gagné's nine events of instruction. (Derived from Robert Gagné, "Conditions of Learning," 1965)

Description of Model

Gagné's nine events of instruction were originally formatted in 1962, with the most widely used model being the Gagné and colleague's version of 1992 (Gagné, Briggs, & Wager, 1992). This theoretical framework focuses on essential aspects of teaching which include presenting knowledge, demonstrating the skill, providing practice with feedback, and providing learner guidance (Gagné, et al., 1992). These essential aspects can further be broken down into nine events of instruction can be used to facilitate the DNP project's educational program regarding

the utilization of gastric ultrasonography to predict aspiration risk in perioperative patients and are detailed below.

Event 1: Gain Attention

Gaining attention, the first event, focuses on ensuring learners are engaged and ready to participate in the educational experience. Methods for gaining attention include stimulation with novelty, uncertainty, and surprise, posing thought-provoking questions, and having learners pose questions to be answered by other learners (Gagné et al., 1992). This will be accomplished by providing a pre-test to grab learner's attention and promote participation in the educational experience.

Event 2: Inform Learners of Objectives

After grabbing learner's attention, educators must affirm the learning objectives. These objectives provide an outline of skills that will be achieved and specific outcomes to be assessed (Cheung, 2016). These objectives will be projected in a PowerPoint presentation and will directly relate to the aims of this DNP project including increased accuracy in identifying three different volumes of gastric content, and increased confidence in gastric image identification after exposure to the educational presentation. These objectives will be measured by administering a post-test and comparing the results to the pre-test.

Event 3: Stimulate Recall of Prior Learning

Stimulating recall or prerequisite knowledge helps establish what learners already know and also unveils knowledge deficits regarding preexisting knowledge. This event is important to instructors as it directs them to what knowledge gaps must be filled before subsequent learning can occur (Cheung, 2016). This can be accomplished by asking anesthesia providers about their

previous experience with ultrasonography and how they can potentially relate it to gastric ultrasonography.

Event 4: Present Stimulus

Presenting the material must be conducted in a meaningful and proficient manner. Effective instruction often entails presenting vocabulary, providing examples, and using a variety of resources to address learning preferences such as lecture, demonstration, and group work (Gagné et al., 1992). This will be accomplished through a PowerPoint presentation and hands-on demonstration regarding effective usage of gastric ultrasonography.

Event 5: Provide Learner Guidance

Providing guidance directs the learner towards the desired objectives by modeling the correct performance (Gagné et al., 1992). This will be accomplished by demonstrating the correct way to scan gastric contents while also providing non-examples of actions to avoid while performing the task to decrease the risk of incorrect readings.

Event 6: Elicit Performance

To elicit performance, learners must be given the opportunity to practice the skill, internalize new knowledge of the skill, and confirm correct understanding of acquired knowledge (Gagné et al., 1992). This will be accomplished by allowing the anesthesia providers to utilize gastric ultrasonography to assess gastric contents on a student model. Learners will take turns performing the skill while other learners and the instructor observe and provide constructive feedback.

Event 7: Provide Feedback

Providing immediate feedback regarding student's performance helps to assess and facilitate learning. Practice without feedback may not lead to improved performance, as learners do not receive a corrective or informative evaluation that may determine what improvements need to be made. Self-appraisal of skills has also shown to enhance learning (Cheung, 2016). Feedback during this educational program will be provided in a context that is non-judgmental, specific, and timely. Feedback will also describe the task performance, provide advice, and encompass the learner's personal goals and expected outcomes regarding gastric ultrasonography. Learners will also be encouraged to evaluate their own performance.

Event 8: Assess Performance

Assessing performance is imperative for evaluating the effectiveness of the educational program. Performance should be tested and evaluated based off of the previously stated learning objectives (Gagné et al., 1992). In order to measure how well students have learned the content and accomplished the aims of the DNP project, a post-test will be administered. The results will then be compared to the pre-test with the goal of expected improvement of gastric content identification and user confidence with gastric ultrasonography.

Event 9: Enhance Retention and Transfer

To further develop the newly gained knowledge of gastric ultrasonography into expertise, learners must internalize knowledge and be able to retain the skills taught. Enhancing retention will strengthen the learner's ability to repeat the skill in a future setting (Cheung, 2016). To help students internalize knowledge and transfer their skills to future settings, a reference including

key steps to follow to assess gastric content in perioperative patients will be provided at the commencement of the educational experience.

Concepts

Gastric Ultrasonography

The objective assessment of gastric contents using an ultrasound machine (Kline, Selai, Ardigo, & Pugh, 2017).

Gastric Content

Defined as either liquid or solid in nature in the stomach.

Liquid components. Include substances such as water, juice, or coffee. These appear on gastric ultrasonography as hypoechoic, or darker in nature compared to surrounding structures.

Gastric contents. Are considered solid and consist of a standard snack or meal and appear as a "frosted-glass" pattern on ultrasonographic examination (Putte & Perlas, 2014).

Gastric Antrum

The gastric antrum is the gastric region that is most amenable to ultrasonographic examination. It is the simplest region to identify and can be found using vascular landmarks. Due to its ease of locating and accurate correlation with gastric contents of the entire stomach, it is deemed the ideal scanning region for assessing gastric contents (Putte & Perlas, 2014).

Empty Antrum

An empty antrum has no appreciable gastric content or volume. It appears flat and collapsed or with a round-to-ovoid shape also describes as a "bull's eye" or "target" pattern (Putte & Perlas, 2014).

Fluid Filled Antrum

An antrum with clear fluid is round and distended with thin walls with the size of the antrum proportional to the gastric volume. The content appears anechoic (black) or hypoechoic (darker than surrounding image). A fluid filled antrum with air bubbles may be seen after ingestion of clear fluids or effervescent drinks and has a "starry night" appearance (multiple air bubbles on hypoechoic background) (Putte & Perlas, 2014).

Full Antrum

A full antrum, filled with solid contents, appears distended with thin walls in the early stages (immediately after ingestion). A "frosted-glass" pattern may be portrayed, due to a mix of solid contents and air, blurring the posterior wall of the antrum and underlying structures. One to two hours after a meal, a full antrum will appear as heterogeneous particulate content.

Synthesis of Evidence

Gastric ultrasonography is an imaging examination that provides valid and reliable information regarding the nature and volume of a patient's stomach content. It is inexpensive and portable, making it a useful tool in the perioperative period. If anesthesia providers utilized gastric ultrasound for assessment of stomach contents perioperatively, qualitative and quantitative data could be captured and used to guide their decision-making process to choose the best strategy to prevent aspiration. Clinical decisions influenced by the results of gastric content and volume include time of surgery, medication administration, and type of airway to be used (Bisinotto et al., 2017).

A thorough literature search to critically appraise the evidence, discover strengths and weakness of current research, pertinent to gastric ultrasound, and determine its transferability

into practice was conducted. The review included utilization of the electronic databases PubMed, Medline, CINAHL, and the Cochrane Library. Use of the key terms: *gastric ultrasound, gastric ultrasonography, anesthesia*, and *aspiration.* Additional applied filters included; English language, human studies, and published within 10 years. This search produced 32 articles, 10 of which are relevant to this DNP project including a clinical practice guideline, systematic review, a randomized control trial, observational studies, and expert opinion, that directly relate to the study question presented: In anesthesia providers, does instructional activity with ultrasonography increase provider accuracy in identifying gastric contents and improve confidence with utilization? The purpose of the synthesis is to gain a plethora of background knowledge and evidence to present to stakeholders in an educational setting. In order for anesthesia providers to make informed clinical decisions using ultrasound, they must first feel comfortable with using the technology. Anesthesia providers have been the leaders in ultrasound use for perioperative tasks such as central vascular access and regional anesthesia. However, perioperative use of ultrasound for assessment of gastric contents is a new theme that has yet to be implemented in everyday practice. Proper education of ultrasound technique is a paramount task required for provider comfort and competency with use (Ramsingh et al., 2015).

Analysis of quality and classification of evidence utilized a seven-level pyramidal hierarchy, formatted in Polit and Beck (2012). The levels ranged from high level I (relevant clinical practice guideline) to low level VII (opinions of authority). Application of the Grades of Recommendation Assessment, Development, and Evaluation (GRADE) outlined in DiCenso, Guyatt, and Ciliska (2005), the literature was assigned grades. This allows for determining the strength of evidence categorized from 'I*A*,' which represents strong recommendations that can

apply to the majority of patients regarding the implementation of gastric ultrasound, to 'I*C*,' which equates to intermediate-strength recommendations that may change through continued research (DiCenso et al., 2005). These recommendations and levels of evidence ultimately inform clinical judgment and usage of gastric ultrasound in the clinical setting (Appendix A).

Strengths

Several articles provided Level I evidence to support gastric ultrasonography; a clinical practice guideline with twelve strong recommendations regarding general ultrasound usage and a systematic review stating ultrasound accurately determines gastric volume which assists clinicians to individualize aspiration risk (Frankel et al., 2015; Putte & Perlas, 2014). The randomized control trial by Perlas and colleagues (2009), concludes that the gastric antrum provides the most reliable imaging of gastric cross-sectional area (CSA) and the study by Bouvet and colleagues (2011) demonstrates the antral CSA can be identified 98.4% of the time by providers, making its measurement a useful indicator for clinical practice. Both of these studies also provide a mathematical model for prediction of aspiration risk (Perlas et al., 2009; Bouvet et al., 2011). The cohort study by Alakkad and colleagues (2015) revealed that standardized point-of-care ultrasound examination led to changes in management in 71% of patients undergoing anesthesia. This study also identified an extensive cost-saving implication, by identifying empty stomachs in patients with shorter than ASA guideline anticipated fasting times. Of the seven cases that would have been canceled based on standard patient assessment and fasting guidelines, five were able to proceed with surgery after gastric ultrasonography was performed and evidence of an empty stomach was confirmed (Alakkad et al., 2015).

Weaknesses

Weaknesses highlighted in the synthesis of evidence relate to the majority of studies being cohort studies, which only to pertain to a level IV of evidence. The bulk of the studies also had relatively small sample sizes, correlating with less accurate power of analysis (Polit & Beck, 2012).

Limitations

Limitations of the literature review include variability in mathematical models for prediction of total gastric volume and applicability of the intervention in vulnerable patient populations. There are two mathematical models by Bouvet and colleagues (2011), Perlas and colleagues (2009), which are only applicable when a patient is in a certain scanning position, and only applies to non-pregnant adults. This creates the need for additional studies to include a comparison of these mathematical models to determine the superior model based on accuracy and patient outcomes. Study findings also lack applicability to patient populations such as children, parturients, and those with multiple comorbidities.

Despite the invaluable information gathered from these studies, another limitation is the variable definition of the volume of gastric content that correlates with aspiration risk, which made data pooling a greater challenge. Primate studies demonstrate the critical volume directly linked to aspiration of gastric contents and increased morbidity and mortality at 0.8 ml/kg or approximately 25-50 ml (Raidoo, Rocke, Brock-Utne, Marszalek, & Engelbrecht, 1990). This volume of aspirate correlates as the amount to produce severe pneumonitis and increase mortality when instilled directly into the trachea. Some studies have adopted this as the critical value while others have adjusted to a higher threshold of 1.5 ml/kg for relevance in humans. The

adjustment comes from the deduction that if 0.8ml/kg were present in the stomach, for aspiration and pneumonia to occur, the stomach would have to be emptied of these contents completely and the aspirate must travel through the vocal cords and enter the trachea. These events have a low probability; therefore, the maximal "safe" gastric volume is expected to be slightly higher than the minimum volume to cause lung damage in primates. Although 1.5 ml/kg is the proposed safe threshold in the majority of studies, it is still unknown if it is the correct value associated with meaningful patient outcomes indicating further research is necessary to bridge this gap. For the purpose of this DNP project, the critical value indicative of an "at risk" stomach is 1.5 ml/kg.

Gaps

An identified gap is lack of research directly pertaining to educating anesthesia providers regarding the use of gastric ultrasonography. One study by Kline and colleagues (2017) however, assesses the effectiveness of a brief educational program on increasing student nurse anesthetist (SRNA) accuracy and confidence in identifying three different volumes of gastric content. This was tested using a pre-test and post-test analysis which resulted in improved post-test mean scores, which were statistically significant ($p<0.001$) and will serve as a foundation for this DNP project. Furthermore, the findings at the conclusion of this project will help close this perceived gap.

METHODS

Project Design

This DNP project included the development of an educational presentation on gastric ultrasonography by the principal investigator (PI) to evaluate accuracy in determining gastric contents after evaluating gastric ultrasound images. Measurable outcomes for this project

included provider knowledge about gastric ultrasonography by obtaining data from a one-group pre-test/post-test survey. This project collected quantitative data that was analyzed statistically comparing the means and standard deviation (SD) of the two related samples utilizing the numerical information gathered from the pretest-posttest surveys.

Setting

This project was conducted at a Level 1 trauma center in Phoenix, AZ, during a scheduled Wednesday morning anesthesia department meeting on October 10, 2018.

Participants

There are approximately 40 CRNAs and 10 Anesthesiologists employed at this facility. An email was sent to all anesthesia providers two weeks prior to the scheduled meeting with approval from the Chief CRNA (Appendix C). The email consisted of a brief description of the DNP project, as well as a request for voluntary participation in the pre-test and post-test questionnaire (Appendix D). Inclusion criteria for this project were: a) participants employed by District Medical Group; and, b) providers involved in direct anesthesia care in the perioperative environment.

A convenience sample of 19 anesthesia providers were in attendance on the day of the presentation, however, only 17 participated in the pre-posttest questionnaire.

Data Collection

Data was collected by means of a pre- and post-test questionnaire (Appendix B) immediately before and immediately following the educational presentation regarding gastric ultrasonography. Both tests had the same image questions (n=8), but the pretest included demographic data (n=5) as well. The participants were given 10 minutes to complete each test,

which was printed on paper. Each participant was given a piece of paper along with their pre-test with a number between 1 and 20. They were instructed to write "pre" with their allocated number at the top of the questionnaire and to turn their papers over after completion of their pre-test, at which time they were collected by the principal investigator (PI).

The educational presentation following the administration of the pre-test questionnaire consisted of a 30-minute PowerPoint presentation adapted from GastricUltrasound.org (http://www.gastricultrasound.org/index.html). This presentation was projected on two large screens in the conference room for easy viewing. Participants were encouraged to ask questions throughout the presentation and a formal question and answer session was offered after completion of the presentation and before administration of the post-test questionnaire.

An identical post-test was then distributed to all participants. They were instructed to write "post" at the top of the paper along with their previously allocated number. Participants were given 10 minutes to complete the post-test. After completion, participants turned their papers over and were again collected by the PI. Pre and post-test numbers were paired accordingly and analyzed. No personal information, including names, addresses, or other personal information was obtained or collected and the PI was the only person who had access to the survey results and data.

Ethical Considerations

Before implementing this project, University of Arizona Institutional Review Board approval was obtained (Appendix E), and the project was deemed "not human research." Three key ethical principles guided the planning and implementation of this DNP project and included respect for persons, beneficence, and justice.

Individuals in the project population consisting of anesthesia providers at the Level 1 trauma center were provided with a voluntary consent to allow participation in the DNP project. This population of professional anesthesia providers was neither vulnerable or in need of special consideration for participation. This project did no harm to those involved and there were no risks associated with participating in this voluntary educational opportunity. No monetary obligation to the organization or its employees to participate in this project were present.

Data Collection Tool

The pre- and post-test was developed by the PI and adapted from the study by Kline and colleagues (2017). The identical pre-test/post-test (Appendix B) consisted of a questionnaire of gastric ultrasound images (n=8) with demographic (n=5) items on the pretest: age, gender, amount of prior experience with interpreting ultrasound images, gastric ultrasound experience, and number of years worked as an anesthesia provider, followed by identification of eight gastric ultrasound images. These images were ranked as no volume, empty antrum; fluid volume; and solid content, based on Perlas and colleague's recommendations (2009).

Data Analysis

Data from the pre-test and post-test questionnaires was input into Excel formatting and each question was analyzed with descriptive statistics including means, percentage correct, and standard deviation. Demographic data was used for describing the population sample. Comparison of pre- and post-test scores were reported on a scale from 1 to 8 and average pre-test and post-test scores were calculated. The standard deviation was calculated as a variability index from scores from the mean (Polit & Beck, 2012). Due to the low cost of printing the

questionnaires and data analysis was completed by the PI, resulting in minimal costs for this project.

RESULTS

A convenience sample of 19 participants attended the presentation, with 89% (n=17) completing the pre and posttest. Question's 1-5 included the demographic data (*N*=5) and included age, gender, years of anesthesia practice, ultrasound experience and years of gastric ultrasound experience (Table 1).

TABLE 1. *Demographic data.*

Demographics	Count	Percentage
Age Group		
20-29	1	5.9%
30-39	9	52.9%
40-49	5	29.4%
50-59	1	5.9%
60+	1	5.9%
Gender		
Male	8	47.1%
Female	9	52.9%
Prior Years Ultrasound Experience		
<1	6	35.3%
1-5	4	23.5%
5-10	5	29.4%
10+	2	11.8%
Gastric Ultrasound Experience		
Yes	0	0.0%
No	17	100.0%
Years Worked as Anesthesia Provider		
<1	3	17.6%
1-5	4	23.5%
5-10	5	29.4%
10+	5	29.4%

The results from the demographic data: 52.9% of participants were ages 30-39 (n=9), 52.9% (n=9) were females, 58.8% (n=10) had > 5 years' experience as an anesthesia provider, 35.3% (n=6) had < 1-year ultrasound experience and 100% (n=17) had no gastric ultrasound experience. There were eight multiple choice questions (Questions 6-13) displaying an image of a gastric antrum with answer choices: a. No volume, empty antrum, b. Fluid volume, or c. Solid content, full antrum (Appendix B). The post-test results for identifying the gastric images (Q6-13) are:

Question 6

This was a picture of a flat, collapsed, empty antrum with no volume. The average pre-test and post-test percent correct were 58.8% and 76.5%, respectively, indicating an increase of 17.65%.

Question 7

This was a picture of a full antrum with solid content depicting a "frosted-glass" appearance. The average pre-test and post-test percent correct were 41.2% and 76.5%, respectively, indicating an increase of 35.29%.

Question 8

This was a picture of a full antrum containing both solid and liquid content with a "starry-night" appearance. The average pre-test and post-test percent correct were 47.1% and 94.1%, respectively, indicating an increase of 47.0%.

Question 9

This was a picture of an empty antrum with a "bull's eye or "target" appearance. The average pre-test and post-test percent correct were 70.6% and 100.0%, respectively, indicating an increase of 29.4%.

Question 10

This was a picture of a fluid filled antrum, anechoic in nature. The average pre-test and post-test percent correct were 58.8% and 100.0%, respectively, indicating an increase of 41.2%.

Question 11

This was a picture of a full antrum with solid content indicated by a "frosted glass" appearance. The average pre-test and post-test percent correct were 47.1% and 70.6%, respectively, indicating an increase of 23.5%.

Question 12

This was a picture of an empty antrum with no volume. The average pre-test and post-test percent correct were 47.1% and 88.2%, respectively, indicating an increase of 41.2%.

Question 13

This was a picture of a full antrum with solid content. The average pre-test and post-test percent correct were 82.4% and 100.0%, respectively, indicating an increase of 17.7%.

In conclusion, the average pre-test score was 4.76/8 or 59.6%. The average post-test score was 7.06/8 or 88.2% (Table 2). This indicates an average increase in score of 2.3 or 28.6%. The standard deviation was smaller in post-test scores compared to pre-test scores (10.9% vs 19.4%), indicating a lesser degree in variability of scores from the mean. This increase in post-

test scores compared to pre-test scores yields evidence of anesthesia provider knowledge gained after exposure to the PowerPoint presentation regarding gastric ultrasonography.

TABLE 2. *Pre-test vs. post-test scores.*

Pre Test Answers	**Number Correct**	**Percent Correct**
No Volume, Empty Antrum		
Question 6	10	58.8%
Question 9	13	70.6%
Question 12	8	47.1%
Fluid Volume		
Question 10	10	58.8%
Solid Content, Full Antrum		
Question 7	8	41.2%
Question 8	9	47.1%
Question 11	8	47.1%
Question 13	15	82.4%
Average Number Correct	***4.8***	
Average Percent Correct		***59.6%***
Standard Deviation		***19.4%***

Post Test Answers	**Number Correct**	**Percent Correct**
No Volume, Empty Antrum		
Question 6	13	76.5%
Question 9	17	100.0%
Question 12	15	88.2%
Fluid Volume		
Question 10	17	100.0%
Solid Content, Full Antrum		
Question 7	13	76.5%
Question 8	16	94.1%
Question 11	12	70.6%
Question 13	17	100.0%
Average Number Correct	***7.1***	
Average Percent Correct		***88.2%***
Standard Deviation		***10.9%***

DISCUSSION

The purpose of this DNP project was to inform and help improve knowledge of gastric images on ultrasound. While all providers who participated in this project had prior general ultrasound experience, none had prior experience with gastric ultrasonography. The data analysis concluded that scores improved, suggestive that correct image identification occurred.

While evaluating post-test scores, respondents had a 100% success rate in identifying an empty antrum, fluid filled antrum, and full antrum based on questions 9, 10, and 13, respectively. Furthermore, a full antrum was identified with a greater than 85% success rate based on questions 7, 8, 11, and 13. These results indicate that anesthesia providers demonstrated increased success with image interpretation of gastric contents after a brief 30-minute educational presentation. These findings have future implications with the implementation of training student registered nurse anesthetists (SRNAs) and CRNAs in gastric ultrasonography, for detecting full antrum's in those patients presenting for surgery who have questionable NPO status. It is the PI's assumption that with increased exposure to ultrasound courses and conferences that focus on hands-on experience and increasing proficiency with gastric ultrasonography, increased competency and expertise will result.

Until recently, anesthesia providers have relied solely on a patient's NPO status and comorbidities when determining their risk of aspiration, anesthesia technique management, and safety to proceed with surgery. Gastric ultrasonography offers an alternative non-invasive assessment of gastric contents which may be incorporated into the assessment of aspiration risk and anesthetic plan decision-making process. With continued education and training, the author believes anesthesia provider's competency with gastric ultrasonography will continue to

increase, and aspiration risk stratification with improve. It is the hope that the skills and knowledge gained from this presentation will ultimately encourage participants to further explore training for use in clinical practice with the prospect of preventing patient harm.

Strengths, Weaknesses and Limitations

A strength to the one-group pre-test/post-test design of this DNP project with baseline knowledge data obtained immediately before the educational intervention and post-test knowledge data obtained immediately after, is the inference that the educational intervention was the most plausible explanation for any knowledge gained regarding gastric ultrasonography image interpretation (Polit & Beck, 2012). Anesthesia providers performed better on image identification immediately following the presentation. Based on the results of this study, post-test scores showed immense improvement from pre-test scores, affirming knowledge gained was present.

A relative weakness of this project was the sample size(n=17) of anesthesia providers. The convenience sample was too small to achieve statistical conclusion validity (Polit & Beck, 2012). Other weaknesses included the length of the educational presentation, lack of hands-on training, and lack of testing the long-term strength of the intervention effects. In order for an educational program to be truly effective, learners should be able to internalize knowledge and be able to retain the skills taught (Cheung, 2016).

The results of this study are limited to the anesthesia provider population at the Phoenix area hospital aforementioned. This implies that the results are not valid for other settings or populations beyond the certified registered nurse anesthetists and physician anesthesiologists that were participants of this DNP project. Further educational interventions regarding gastric

ultrasonography competency among anesthesia providers are needed to interpret knowledge gained and the efficacy of the educational program.

DNP Essentials

The University of Arizona's Doctor of Nursing Practice (DNP) curriculum incorporates eight DNP Essentials which are foundational outcome competencies presumed essential for graduates of a DNP program (American Association of Colleges of Nursing [AACN], 2006). The core competencies, or DNP essentials, foundational to this DNP project include:

Essential I – Scientific Underpinnings for Practice

The scientific foundations in this DNP project included integrating nursing science with knowledge from utilizing gastric ultrasonography to inform advanced nursing practice on how to interpret different volumes and content in the gastric antrum. This project also incorporated Gagné's *Nine Events of Instruction* as a conceptual framework to guide practice innovation (AACN, 2006).

Essential II – Organizational and Systems Leadership for Quality Improvement

This project demonstrated clinical leadership through evaluating care delivery approaches regarding the assessment of aspiration risk that meet current and future needs of perioperative patients (AACN, 2006).

Essential III – Clinical Scholarship and Analytical Methods for Evidence-Based Practice

Clinical scholarship and evidence-based practice were elemental in this project as literature regarding gastric ultrasonography was critically appraised and data was collected and analyzed to improve advanced nursing practice (AACN, 2006).

Essential VIII – Advanced Nursing Practice

This project focused on evaluating the therapeutic intervention gastric ultrasonography assessment based on nursing science and the science of ultrasonography. The information gathered from this evaluation was then used to guide and educate advanced practice providers to facilitate optimal care and perioperative patient outcomes through innovational assessment of gastric contents (AACN, 2006).

Dissemination Plan

The information gathered from this DNP project may provide valuable insight related to utilization of gastric ultrasonography in practice, which may ultimately improve the health and well-being of patients in the perioperative period. The data will be shared with the anesthesia providers who participated in the project, the Arizona Association of Nurse Anesthetists Sun & Fun conference in March of 2019 and the New Mexico CRNA spring meeting.

Conclusion

This DNP project concluded that anesthesia providers were better able to recognize different types of gastric contents and distinguish between empty and full antrums after an educational presentation. Utilizing this information, anesthesia providers may continue to develop their gastric ultrasonography interpretation skills with hopes of adopting this preoperative scan into their anesthetic plan of care. Preoperative gastric screening may lead to a better understanding of a patient's gastric content or NPO status, which may ultimately predict aspiration risk. Educating anesthesia providers on the usefulness and efficacy of gastric ultrasonography and providing image interpretation guidance has shown to increase provider accuracy in identifying different types and volumes of gastric contents. Using the non-invasive

tool of gastric ultrasonography, anesthetic care may be discussed and tailored to reduce the risk of aspiration, thereby potentially improving patient, provider, and healthcare facility outcomes.

APPENDIX A:

LITERATURE REVIEW OF GASTRIC ULTRASONOGRAPHY

Author / Article	Research Question/Hypothesis	Design	Sample (N)	Data Collection (Instruments/tools)	Findings
Alakkad et al., 2015	Will the addition of point-of-care gastric ultrasound to standard patient assessment result in changes in anesthetic management in at least 30% of elective surgical patients who do not follow fasting instructions?	Cohort study	38 patients Inclusion criteria: - 18-80 y/o - ASA[1] physical status I-III - Weight 50-100 kg - Height > 150 cm - Presenting for elective surgical procedures under anesthesia without following fasting instructions* - Exclusion criteria: Pregnancy and abnormal upper gastrointestinal anatomy	Primary outcomes measured: - Changes in anesthetic/surgical timing Secondary outcomes measured: - Incidence of changes in anesthetic technique or airway management strategy - Incidence of perioperative regurgitation, aspiration, and postoperative nausea and vomiting - Gastric ultrasound examination performed by staff anesthesiologist or anesthesiology fellow from 4 months – 5 years previous gastric ultrasound experience that were not actively involved in the patient's care - Curvilinear array low-frequency transducer used to exam patients in supine and RLD[2] position - Four categories of gastric antrums identified: (1) Empty (2) Low volume clear liquid (<1.5 ml/kg) (3) High volume clear liquid (>1.5 ml/kg) (4) Thick fluid or solid content - SAS version 9.3 software used for data analysis - McNemar's test (or Bowker's test of symmetry) was used to test differences in anesthetic management plan before vs after ultrasound examination	- Standardized point-of-care ultrasound examination led to changes in management in 27 (71%) of patients o 21 of these patients (55%) had revised timing of anesthesia and surgery - Changes occurred in both directions o Empty stomachs documented after shorter than anticipated fasting times o Full stomachs with a significant amount of solid or fluid contents remained following 8 hours of fasting - Results suggest that the addition of point-of-care gastric ultrasound can allow the anesthesiologist to tailor risk assessment and guide anesthetic management to the specific individual rather than to rely strictly on generic assumptions based on average gastric emptying times
Bouvet et al., 2011	Specific aims: 1. To confirm the feasibility of the ultrasonographic	Observational Study	183 patients - 1.07 M/F ratio - 31- 67 y/o - Height: 159-177 cm	- Preoperative antral CSA ultrasound measurement by blinded physician	- There is a significant positive relationship between antral CSA and aspirated fluid volume

Author / Article	Research Question/Hypothesis	Design	Sample (N)	Data Collection (Instruments/tools)	Findings
	measurement of CSA[3] in a large population of patients 2. To determine a relationship between CSA measured before the induction of anesthesia for emergency or elective surgery and the aspirated volume of gastric contents obtained through a gastric tube in these patients 3. To assess whether ultrasonographic measurement of antral CSA could be used easily for the diagnosis of at-risk stomach during the preoperative period		- 55- 79 kg - BMI: 20-26 kg/cm2 Emergency surgery: N=76 ASA physical status: 1 N=101, 2 N=61, 3 N=13, 4 N=5	- Intraoperative aspiration of gastric contents through Salem tube - Antral CSA values and aspirated volume of gastric content compared using independent 2-tailed Student *t* tests - Volume (ml) = - 215 + [(57 x log (CSA)] – [0.78 x Age (years)] – [0.16 x Height (cm)] – [0.25 x Weight (kg)] – (0.80 x ASA) + 16 - Linear multiple regression used to model relationship between CSA and gastric volume - $p < 0.05$ considered statistically significant	- The cutoff value of antral CSA of 340 mm^2 for the diagnosis of risk stomach was associated with a sensitivity of 91% and a specificity of 71% - CSA measurement is sensitive to detect as little as 25 mL gastric fluid
Frankel et al., 2015	To establish evidence-based guidelines for the use of bedside ultrasound by intensivists and specialists in the ICU and equivalent care sites for diagnostic and therapeutic purposes	Clinical Practice Guideline	24 statements regarding the use of bedside ultrasonography	- Literature review of high-quality evidence pertaining to ultrasound in the ICU setting - Expert panel formation by guideline subcommittee (methodologist, surgical, medical, and anesthesia intensivists - Dialogue conducted through teleconference and electronic-based discussion - GRADE* system, expert consensus, and panel judgment was used to determine strength of recommendations	- 12 approved strong recommendations regarding general ultrasound (strength class 1)
Dupont et al., 2017	Primary objective: Use ultrasound to measure gastric antral cross-sectional area and estimate gastric volume in	Cohort study	300 patients - Undergoing non-elective - Fasted for at least 6 hours	- Patient's gastric antrum scanned in RLD position - Median of three CSA measurements used to estimate	- Median area = 333mm^2 which was associated with body mass index and

Author / Article	Research Question/Hypothesis	Design	Sample (N)	Data Collection (Instruments/tools)	Findings
	patients before unplanned surgery after at least a six-hour fast		- 18+ y/o - Negative gastrointestinal disorders	gastric volume utilizing the Bouvet and colleagues mathematical model - Univariate logistical regression to identify variables present in more than 3% of samples that associated with gastric cross-sectional area at $p < 0.20$, which was retained in a multivariate model if $p < 0.05$ - Adjusted R^2 to determine the inclusion of variables in multivariable regression - SAS Windows for data analysis	morphine consumption, but no fasting time - Measured areas > 410 mm^2 in 92 (35%) participants - Mean standard deviation of gastric contents of 45.8 (34.0) ml, 93 (40%) of which were > 0.8 ml/kg, with 13 (6%) > 1.5 ml/kg - The duration of pre-operative fasting cannot be used as a surrogate for gastric area and by inference, volume
Kline et al., 2017	To determine if, after exposure to a presentation about ultrasound evaluation of gastric contents, will student nurse anesthetists be better able to recognize three different volumes of gastric contents accurately?	Observational study	110 Nurse Anesthesia Students	- Eight images of gastric antrum contents - Anonymous pre-test 20-item questionnaire including demographic items: age, gender, ultrasound experience, critical care experience; study questions: gastric volume estimate and confidence in accuracy of estimates - 45-minute lecture on the use of ultrasound imaging by anesthesia providers to determine the volume of gastric contents prior to induction of surgical patients - Anonymous post-test with same pre-test questionnaire in randomized order	- Post-test average score of 5.03 correct identifications out of possible 8 - Post-test mean score > pretest score o [$t(110 = 15.84; P < 0.001$] = highly statistically significant - Increased accuracy in identification of gastric volumes after instructional lecture - Increased student confidence in evaluations of gastric antrum image identification after instructional lecture
Perlas et al., 2009	Specific aims: 1. To describe the sonographic appearance of the stomach when empty and after ingestion of standardized volumes of fluid and a solid meal	Randomized Control Trial	36 healthy subjects - 21- 42 y/o - 1.25 M/F ratio - Height: 162-177 cm - 58.4-80 kg - BMI: 20.5-26 kg/cm2	- Eight hours of fasting - Random assignment of fluid ingestion volumes - 0 ml ingestion = control - 100, 200, 300, 400, 500 mL = randomized ingestion volumes	- Antrum provides most reliable imaging of gastric CSA - Statistically significant (log-transformed) correlation between CSA-supine and volume

Author / Article	Research Question/Hypothesis	Design	Sample (N)	Data Collection (Instruments/tools)	Findings
	2. To determine the cross-sectional area (CSA) of antrum, body, and fundus using ultrasound before and after fluid and solid ingestion 3. To determine if there is a numerical correlation between ingested volume and CSA in different parts of the stomach (antrum, body, and fundus)			- Blinded certified sonographer assessed gastric antrum - CSA of antrum in supine and RLD position - Distribution of CSA measures investigated graphically using a histogram - Pearson correlation between CSA-lateral, CSA-supine, and volume	(rho=0.659, $p < 0.0001$), CSA-lateral and volume (rho=0.731, $p < 0.0001$), and CSA-supine and CSA-lateral (rho= 0.759, $p < 0.0001$) - Generation of mathematical formula and confidence bands to be used for prediction of gastric volume
Putte et al., 2017	To evaluate the incidence of full a stomach in a population of fasted patients presenting for elective surgery using bedside gastric ultrasound	Cohort study	538 patients Inclusion criteria: - > 16 y/o - ASA physical status I-III - Undergoing elective surgery under general anesthesia - Having followed institutional fasting guidelines* - Exclusion criteria: pregnancy and abnormal upper gastrointestinal anatomy	- Ultrasound exams performed in preoperative period by anesthetist with 5 years of experience in gastric ultrasound or a resident under direct staff supervision - Standardized scanning protocol followed using curvilinear low-frequency transducer - Volume of clear fluid measured using a cross-sectional area of the gastric antrum in the right lateral decubitus position with the following mathematical model applied: Volume (ml) = 27 + (14.6 x Right-lat CSA) - (1.28 x age) - Antrum further classified according to a 3-point grading system: Grade 0 = absence of appreciable gastric content Grade 1 = Clear fluid only appreciable in the antrum in RLD Grade 2 = clear fluid documented in supine and RLD positions - Assumption of normal distribution of continuous	Orthopedics 62.4% Abdominal surgery 11.2% General Surgery 10% Maxillofacial surgery 6.9% Gynecology 2.8% Urology 2% Endoscopy 1.7% Other 3% Mean fasting times: - 10.8 hrs fluids - 13.9 hrs solids 32 patients (6%) = full stomach - Of these, 9 patients (1.7%) = solid content and 23 (4.5%) = clear fluid > 1.5 ml/kg - Younger than those with an empty stomach (P= 0.0033), but no difference in all other patient characteristics, comorbidities, and fasting times 480 patients = empty stomach A fasting gastric volume in healthy individuals is 0.6 ml/kg with values of up to about 100–130 ml 1.5 ml/kg of gastric fluid is considered an at-risk

Author / Article	Research Question/Hypothesis	Design	Sample (N)	Data Collection (Instruments/tools)	Findings
				variables checked with Shapiro-Wild test - Means compared using student's t-test or one-way analysis of variance - Non-normally distributed continuous variables were analyzed using non-parametric statistics (Mann–Whitney U-test/Wilcoxon signed-rank test; Kruskal–Wallis equality-of-populations rank test among grades) - Categorical data are expressed as the count and percentages or ratios and analyzed with the Fisher exact test - Difference considered significant if P< 0.05 - Statistical analysis performed using SAS 9.4 for windows	stomach, but further studies are needed to see if this is the correct value associated with meaningful patient outcomes Gastric ultrasonography identified a small portion of elective surgical patients that presented a full stomach despite recommended fasting times
Putte & Perlas, 2014	All included studies answered at least 1 of these questions: 1. Can ultrasound determine the nature of gastric content (empty, clear fluid, or thick fluid/solid)? 2. Can ultrasound estimate the volume of gastric fluid?	Systematic Review	17 articles Eight (qualitative assessment of gastric content) Seven (quantitative assessment of gastric content Two (mixed methods assessment of gastric content)	- Recommendations and checklist of PRISMA* statement followed - Search of PubMed, OVID Medline, EMBASE Inclusion criteria: MeSH headings a. Gastric ultrasonography b. Gastric ultrasound c. Gastric sonography AND stomach or antrum - English - Humans - Experimental studies, case series, or OBS*	- Ultrasound accurately determines gastric volume - Solids and thick fluids can be differentiated on assessment - Gastric ultrasound can help clinicians individualize aspiration risk
Putte & Perlas, 2017	Is there a link between gastric volume and aspiration risk?	Opinion of authorities	N/A	- Brief overview of recent publications pertaining to point-of-care ultrasound to assess gastric volume in humans	- Studies confirm that gastric volumes of up to 1.5 mL/kg are normal in healthy fasted individuals with baseline risk which

Author / Article	Research Question/Hypothesis	Design	Sample (N)	Data Collection (Instruments/tools)	Findings
					correlates with a CSA between 9cm^2 and 10cm^2 in the right lateral decubitus position - Gastric ultrasound assessment is highly specific for ingestion of food or fluids since no more than 3-5% of fasted individuals will have volume of > 1.5 mL/kg - A large prospective study with randomized subjects with questionable fasting status divided into ultrasound or no ultrasound assessment and further measurement of incidence of perioperative aspiration would be ideal - More studies are needed to determine the best methods to teach and learn the skill of gastric ultrasonography to predict aspiration risk
Raidoo et al., 1990	What is the critical volume for the production of severe pneumonitis following pulmonary aspiration of gastric contents?	Observational study	24 juvenile monkeys Exclusion criteria: HR > 140, RR > 40	- Monkeys randomly divided into four groups to receive four different volumes of gastric aspirate at a pH of 1 o Group 1 = 0.4 ml/kg o Group 2 = 0.6 ml/kg o Group 3 = 0.8 ml/kg o Group 4 = 1.0 ml/kg - Subjects induced with ketamine, intubated, and blinded volumes of gastric aspirate were instilled into endotracheal tube	- One monkey died in group 3 and three monkeys died in group 4 after pulmonary aspiration - Critical volume for gastric aspiration in monkeys is 50 ml or 0.8 ml/kg

Author / Article	Research Question/Hypothesis	Design	Sample (N)	Data Collection (Instruments/tools)	Findings
				- Subjects ventilated for 1 minute with a tidal volume of 20ml/kg and then extubated - A blinded observer noted temperature, heart rate, ventilatory frequency, degree of cyanosis (mild, moderate, severe) and presence or absence of wheezing on auscultation - Chest radiographs at 2 and 6 hours after aspiration	

ASA[1] American Society of Anesthesiologists. RLD[2] Right lateral decubitus. CSA[3] Cross-sectional area.
* Minimum of 2h for clear fluids, 6h for a light meal, and 8h for a meal that included fried or fatty food

APPENDIX B:

GASTRIC ULTRASOUND QUESTIONNAIRE

Gastric Ultrasound Questionnaire

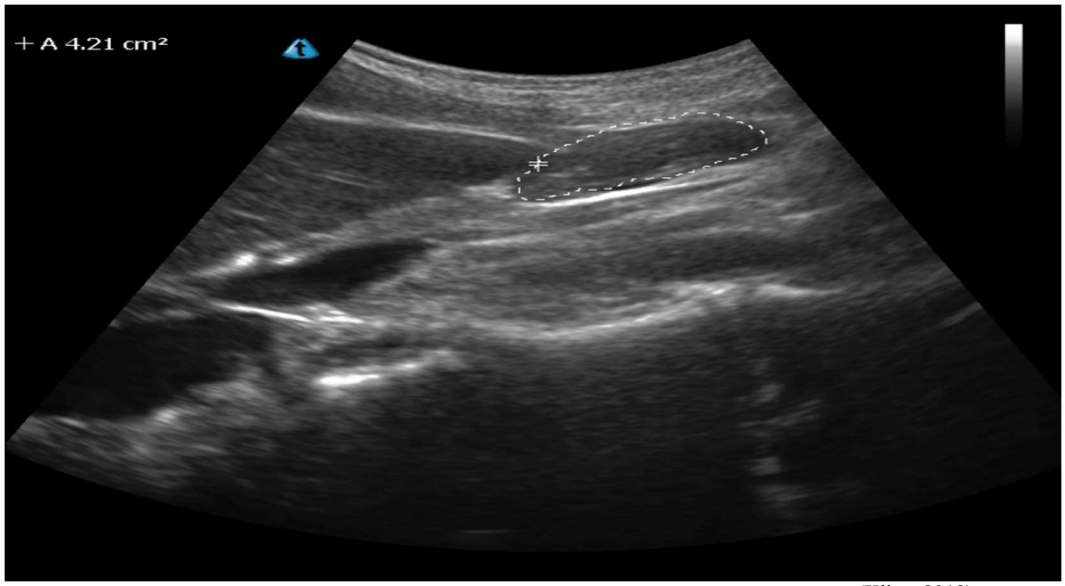
1. In what age group are you in?
   a. 20-29
   b. 30-39
   c. 40-49
   d. 50-59
   e. 60 +

2. Gender
   a. Male
   b. Female

3. Prior years of ultrasound experience
   a. < 1
   b. 1-5
   c. 5-10
   d. 10+

4. Do you have experience in gastric ultrasonography?
   a. Yes
   b. No

5. Number of years worked as an anesthesia provider
   a. < 1
   b. 1-5
   c. 5-10
   d. 10+

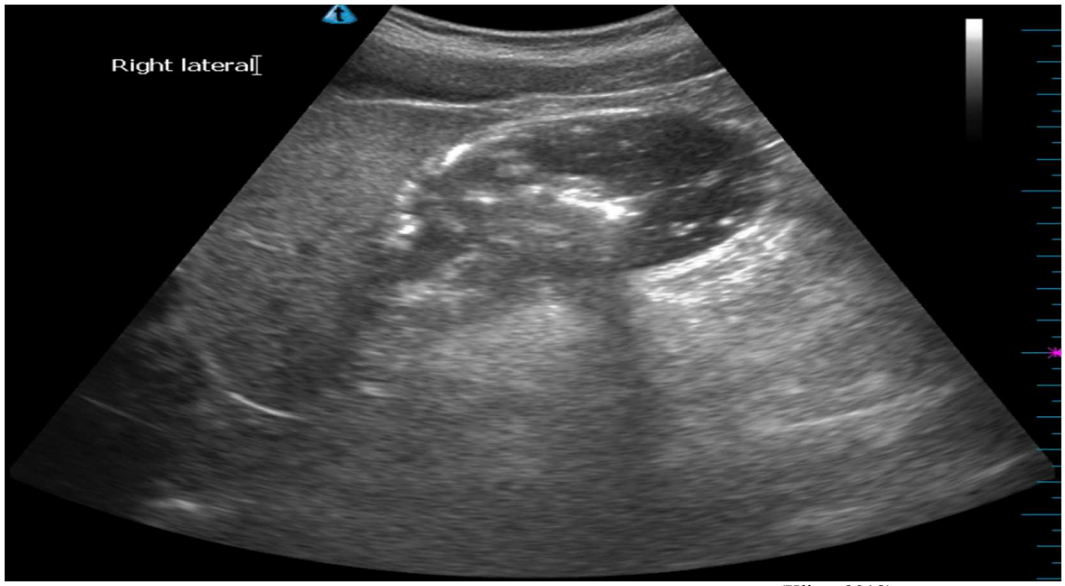


(Kline, 2018)

6. Antrum rating
    a. No volume, empty antrum
    b. Fluid volume
    c. Solid content, full antrum

(Kline, 2018)

7. Antrum rating
    a. No volume, empty antrum
    b. Fluid volume
    c. Solid content, full antrum

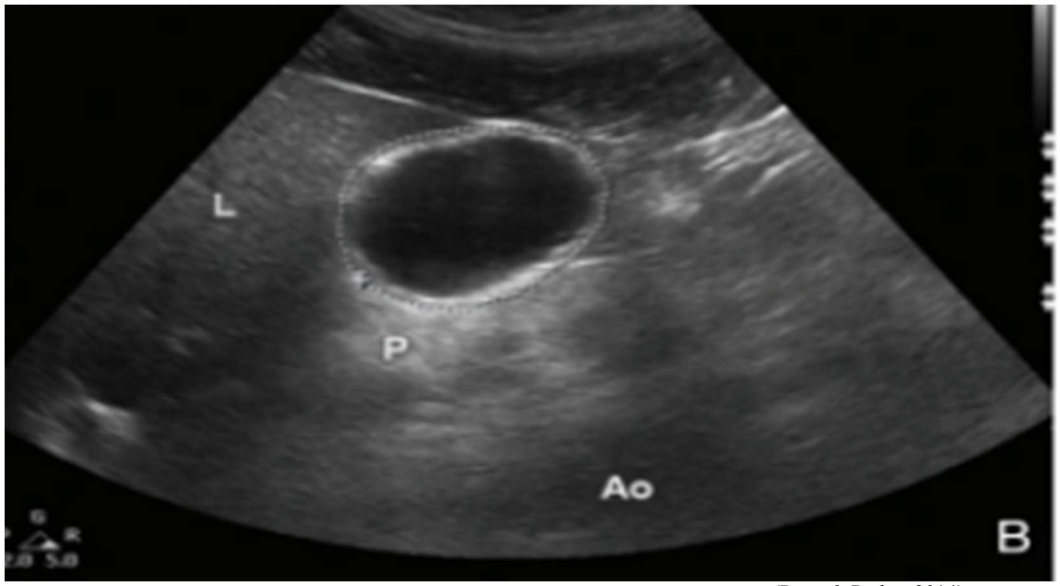


(Kline, 2018)

8. Antrum rating
    a. No volume, empty antrum
    b. Fluid volume
    c. Solid content, full antrum

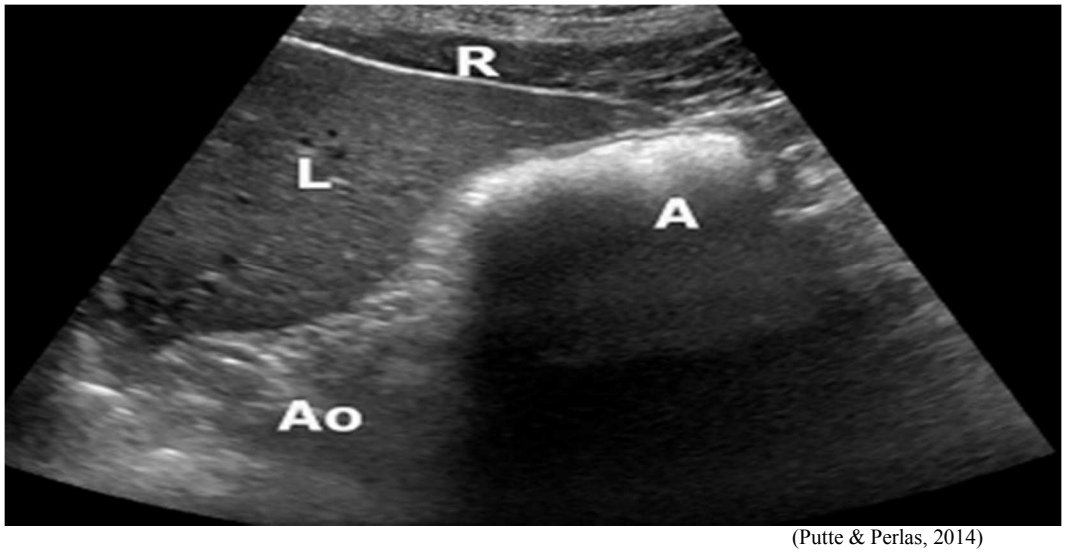
(Putte & Perlas, 2014)

9. Antrum rating
    a. No volume, empty antrum
    b. Fluid volume
    c. Solid content, full antrum



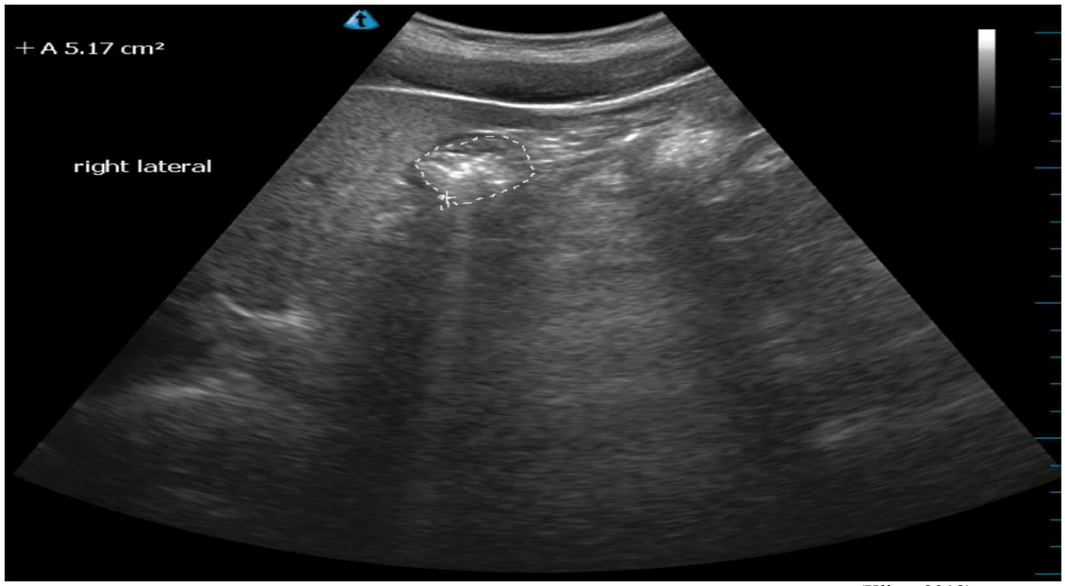
(Putte & Perlas, 2014)

10. Antrum rating
    a. No volume, empty antrum
    b. Fluid volume
    c. Solid content, full antrum



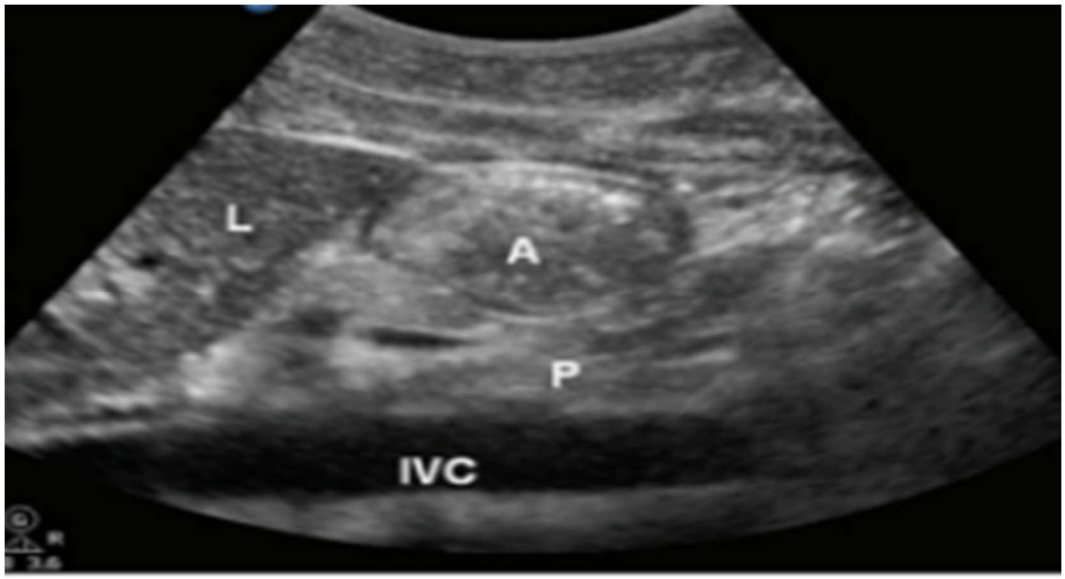
(Putte & Perlas, 2014)

11. Antrum rating
    a. No volume, empty antrum
    b. Fluid volume
    c. Solid content, full antrum



(Kline, 2018)

12. Antrum rating
    a. No volume, empty antrum
    b. Fluid volume
    c. Solid content, full antrum



(Putte & Perlas, 2014)

13. Antrum rating
    a. No volume, empty antrum
    b. Fluid volume
    c. Solid content, full antrum

APPENDIX C:

SITE AUTHORIZATION FORM

Site Authorization Form
-------- Integrated Health System
2601 E Roosevelt St
Phoenix, AZ 85008

6/4/18

University of Arizona Institutional Review Board
c/o Office of Human Subjects
1618 E Helen St
Tucson, AZ 85721

Please note that Ms. Tricia Hoffner, UA Doctor of Nursing Practice student, has permission of the -------- Integrated Health System and District Medical Group to conduct an educational presentation at our facility for her project, "Educational Intervention for Gastric Ultrasonography Competency Among Anesthesia Providers."

Ms. Hoffner will conduct a pretest and posttest with anesthesia providers at -------- Integrated Health System. She will recruit providers through email and anesthesia department meeting attendance. The email will provide a description of the project, what they will be asked to do, and the time involved. Ms. Hoffner has agreed to provide to my office a copy of the University of Arizona Determination of Human Research form before she recruits participants. She will also present aggregate results to the providers through email.

If there are any questions, please contact my office.

Signed,

APPENDIX D:

LETTER OF INTENT

Dear Anesthesia Staff,

My name is Tricia Hoffner and I am an SRNA from the University of Arizona. I have had the pleasure of working with many of you during my first clinical rotation at your facility. I will be implementing my Doctor of Nursing Practice project at your facility during the Wednesday morning anesthesia department meeting on October 10th, 2018. Please see the description of my project below and let me know if you have any questions. Your participation would be greatly appreciated. Thank you.

Educational Intervention for Gastric Ultrasonography Competency Among Anesthesia Providers

Tricia M. Hoffner, SRNA

The purpose of this project is to use evidence-based research to educate anesthesia providers at a Level I Trauma Center in Phoenix on the efficacy and usefulness of gastric ultrasonography, how to use ultrasound for assessment of gastric contents, and how to interpret the results.

If you choose to take part in this project, you will be asked to complete a paper pre-survey about gastric ultrasonography. It will take approximately 10-15 minutes to complete this survey. I will present a 30-minute educational presentation after everyone has completed the pre-survey and following the educational presentation, there will be a post-survey to evaluate if you gained knowledge from my presentation. There are no foreseeable risks associated with participating in this project and you will receive no immediate benefit from your participation. Survey responses are anonymous.

If you choose to participate in the project, participation is voluntary, refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may withdraw at any time from the project. In addition, you may skip any question that you choose not to answer. By participating, you do not give up any personal legal rights you may have as a participant in this project.

For questions, concerns, or complaints about the project, you may call Tricia Hoffner, SRNA at 701-730-5787. My email address is thoffner@email.arizona.edu

Tricia Hoffner, SRNA
DNP-NA Specialty Student Class of 2019

APPENDIX E:

THE UNIVERSITY OF ARIZONA INSTITUTIONAL REVIEW BOARD (IRB) APPROVAL LETTER

THE UNIVERSITY OF ARIZONA
Research, Discovery & Innovation

Human Subjects Protection Program

1618 E. Helen St.
P.O.Box 245137
Tucson, AZ 85724-5137
Tel: (520) 626-6721
http://rgw.arizona.edu/compliance/home

Date:	September 17, 2018
Principal Investigator:	Tricia Hoffner
Protocol Number:	1809932324
Protocol Title:	Educational Intervention for Gastric Ultrasonography Competency Among Anesthesia Providers
Determination:	Human Subjects Review not Required

Documents Reviewed Concurrently:

Data Collection Tools: *Gastric Ultrasound Post-test.docx*
Data Collection Tools: *Gastric Ultrasound Pre-test.docx*
HSPP Forms/Correspondence: *Advisor Confirmation Email.pdf*
HSPP Forms/Correspondence: *determination.pdf*
Informed Consent/PHI Forms: *Diclosure form.doc*
Other: *DNP Project Presentation .pptx*
Other Approvals and Authorizations: *Hoffner_Site authorization signed.pdf*
Recruitment Material: *Maricopa Recruitment Email.docx*

Regulatory Determinations/Comments:

- Not Human Subjects Research as defined by 45 CFR 46.102(f): as presented, the activities described above do not meet the definition of research involving human subjects as cited in the regulations issued by the U.S. Department of Health and Human Services which state that "human subject means a living individual about whom an investigator (whether professional or student) conducting research obtains data through intervention or interaction with the individual, or identifiable private information."

The project listed above does not require oversight by the University of Arizona.

If the nature of the project changes, submit a new determination form to the Human Subjects Protection Program (HSPP) for reassessment. Changes include addition of research with children, specimen collection, participant observation, prospective collection of data when the study was previously retrospective in nature, and broadening the scope or nature of the study activity. Please contact the HSPP to consult on whether the proposed changes need further review.

The University of Arizona maintains a Federalwide Assurance with the Office for Human Research Protections (FWA #00004218).

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